STUDIES IN AUSTRALIAN AQUATIC HEMIPTERA

No. VII[1]

By HERBERT M. HALE.

Text figures 81-90.

ALTHOUGH the word "aquatic" may be legitimately applied to insects which live on the surface of the water, or which frequent the margin of waters, forms living in such situations are often referred to as having a "semi-aquatic" habit, in contradistinction to species which swim beneath the surface film.

The types of the species herein described as new have been placed in the Museum.

GYMNOCERATA.

The members of the five families placed in this division are semi-aquatic in habit; representatives of three of the families have been previously described from Australia, and a member of each of the others is herein recorded. The families are readily separated as follows:

KEY TO FAMILIES.

a. Form not linear: head shorter than thorax.
  b. Claws placed at end of tarsi, the last joint of which is entire.
    c. Body robust; tarsi two-jointed. (Antennae five-jointed in our genus) .. .. .. *Naeogeidae.*
    cc. Body rather slender; tarsi three-jointed and antennae four-jointed .. .. .. *Mesoveliidae.*
  bb. Claws of front tarsi (at least) not apical, but inserted in a nick or cleft in the terminal tarsal joint.
    d. Rostrum three-jointed .. .. *Veliidae.*
    dd. Rostrum four-jointed .. .. *Gerridae.*
aa. Form linear; head as long as thorax .. .. *Hydrometridae.*

Some authors reduce the last four families to the status of sub-families of the Hydrometridae; and some exclude the family Naeogeidae from the Gerroidea, placing it elsewhere in the Gymnocerata.

FAMILY NAEOGEIDAE.

The tiny bugs belonging to this family are found near water, but rarely

(1) No. v in Archiv f. Zool., K. Svenska Vet.-Akad., xviiA, 1925, No. 20; No. vi in Proc. Linn. Soc., N.S. Wales, xlix, 1924, p. 461 to 467.

venture on the surface film. Four genera are known, and the various species have been taken beneath leaves or in tufts of vegetation bordering the water, on rocks in mid-stream, and walking on the water. In the members of this and the next family the tarsi are not so perfectly modified for walking on the surface-film as in those of the Veliidae.

I have followed Horvath (2) in placing the Naeogeidae in the superfamily Gerroidea; Jaczewski *(ut infra)* considers that the structure of the male genital segments in *N. ruficeps* Thoms. indicates that the family is more nearly related to the Myodochidae (Lygaeidae) and Pyrrhocoridae.

NAEOGEUS Laporte.

Naeogeus Laporte, Essai. Hémip., 1832, p. 34; Jaczewski, Bull. Ent. Pologne, i, 1922, p. 13.

Hebrus Curtis, Ent. Month. Mag., i, 1833, p. 198: Amyot & Serv., Hem., 1843, p. 294; Fieb., Europ. Hem., 1861, p. 32 and 104.

Type, *Lygaeus pusillus* Fallen (*Naeogeus erythrocephalus* Laporte).

The body is plump, and the legs are stout and placed widely apart on the sternum; the tarsi bear curved, terminal claws. The antennae are five-segmentate, with an auxiliary jointlet at the base of the flagellum (third to fifth segments) and a tiny, collar-like jointlet between the first and second flagellal segments. As far as is known the adults are always winged.

NAEOGEUS LATENSIS sp. nov.

♂ Form broad, not narrowed posteriorly, about two and one-fourth times longer than greatest width. Head, pronotum, and scutellum dark brown, shot with metallic blue and green reflections, finely pilose. Head about as long as first two joints of antennae. Antennae testaceous, in parts darkened; as long as head and pronotum together; first segment longer than second, and as long as third without basal jointlet; second and fourth, and third and fifth segments subequal. Pronotum less than twice as wide as its median length, much longer than head; humeral angles tumid, prominent, and rounded; a discal fovea margined with a few coarse punctures; a line of punctures bordering the posterior edge and extending upwards along the inner side of the humeral tumidities. Keel of scutellum very distinct, not extending quite to posterior angle. Hemelytra almost reaching to termination of abdomen; clavus and corium velvety brownish-black, clothed with bright golden hairs; inner anterior angle of clavus with a large, elongate, sub-triangular spot; membrane greyish-brown, dull, with four

(2) Horv., Ann. Mus. Nat. Hungarici, xiii, 1915, p. 535-536.

indistinct pale spots. Rostrum testaceous, extending to level of posterior acetabula. Underside black, shining, clothed with dense pubescence between posterior coxae, but with sparse hairs on rest of sternum; ventral surface of abdomen with rather long, dense, golden pubescence. Legs testaceous, with the apices of femora and tarsi, and basal third of tibiae, darkened. Anterior femora equal in length to the tibiae, which are about two and one-half times as long as

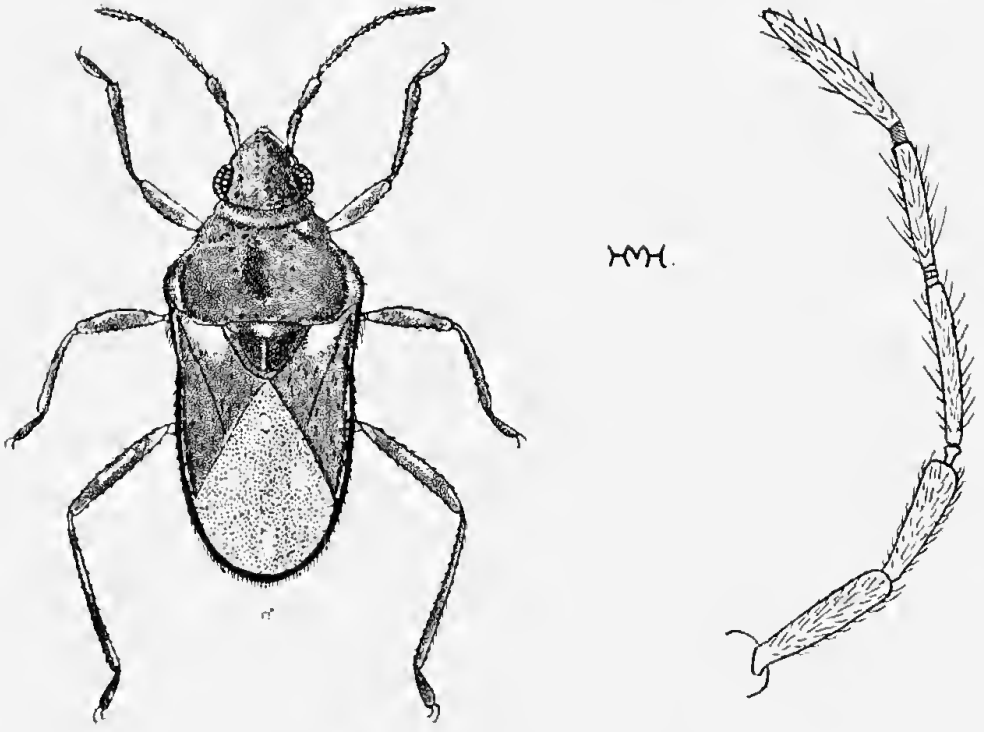

Fig. 81. *Nucogens latensis*, male.

tarsi. Intermediate femora a little shorter than tibiae, which are almost three times as long as tarsi. Posterior tibiae longer than femora and more than three times as long as tarsi.

♀ A little more robust than the male.

Length, 1·3 mm. to 1·95 mm.; width, ·6 mm. to ·85 mm.

Hab. South Australia: Adelaide (type loc.) and Myponga Swamps (H. M. Hale); Tasmania: Devonport (A. M. Lea); New South Wales: Glenfield (A. M. Lea).

This beautiful little bug is the first of the family to be recorded from Australia; it somewhat superficially resembles *N. bombayensis* Paiva, but differs in the proportions of the antennal segments.

N. latensis may be found in numbers at the base of grass tufts bordering our creeks, and is easily obtained by shaking tussocks over a white sheet.

In perfect examples the sculpture of the pronotum is almost or quite hidden by the pubescence, and the head, pronotum, and scutellum appear metallic bluish-green; the underside is sometimes sprinkled with tiny spots of similar colour.

FAMILY MESOVELIIDAE.

Most of the representatives of this small family run on the surface film of quiet waters, but a species from New Guinea, *Phrynovelia papua* Horvath ([3]), was not found on water, but on fallen leaves in the forest.

No *Mesoveliae* are included in the material I have examined from the Australian museums, although, at least in certain localities, the species described below is anything but rare.

MESOVELIA Mulsant and Rey.

Mesovelia Muls. & Rey, Ann. Soc. Linn. Lyon, 1852, p. 138; Horv., Ann. Mus. Nat. Hungarici, xiii, 1915, p. 543 (refs.).

Fieberia Jak., Trudy Russk. Ent. Obshtsh., vii, 1874, p. 32.

Type, *M. furcata* Mulsant and Rey.

MESOVELIA HUNGERFORDI sp. nov.

Apterous ♂. Form narrowly sub-oval, widest at metathorax, three and two-thirds times longer than wide. Head greenish, with a black marking anteriorly, with a brown, longitudinal, median line, and with three pairs of setiferous black dots, two pairs in front of eyes and one pair near posterior margin; clothed with black hairs over greater part of dorsum, and with whitish hairs anteriorly; an outstanding black seta in front of each eye; medial length greater than width, including eyes. Antennae brown, pilose, reaching back to posterior margin of sixth abdominal segment; first segment with two setae not far from apex; about one-third as long again as second, and nearly as long as third, which is subequal in length to fourth segment. Notum greenish, in parts faintly marked with brown; clothed with short black hairs; pronotum with a very slightly oblique, shallow fovea on each side; medial length of mesonotum greater than that of pronotum and twice the medial length of metanotum. Abdomen green, with lateral margins of connexivum and sutures brown; clothed with short brown hairs, which merge into longer and denser hairs on genital segments; sutures of first two segments not well defined, but nevertheless distinctly visible. Connexivum sub-horizontal. Rostrum greenish-ochraceous, with apical fifth

(3) Horv., *loc. cit.*, p. 535, 555, fig. 9.

black; reaching to between anterior margins of hind coxae. Underside pilose, greenish-ochraceous, the abdomen in parts darkened; first genital segment with two large, slightly oblique ridges, each elevation about one-half as long as the segment and bearing short brown spines. Legs long, pale beneath and brownish above, with tarsi and apices of femora and tibiae brownish-black; clothed with

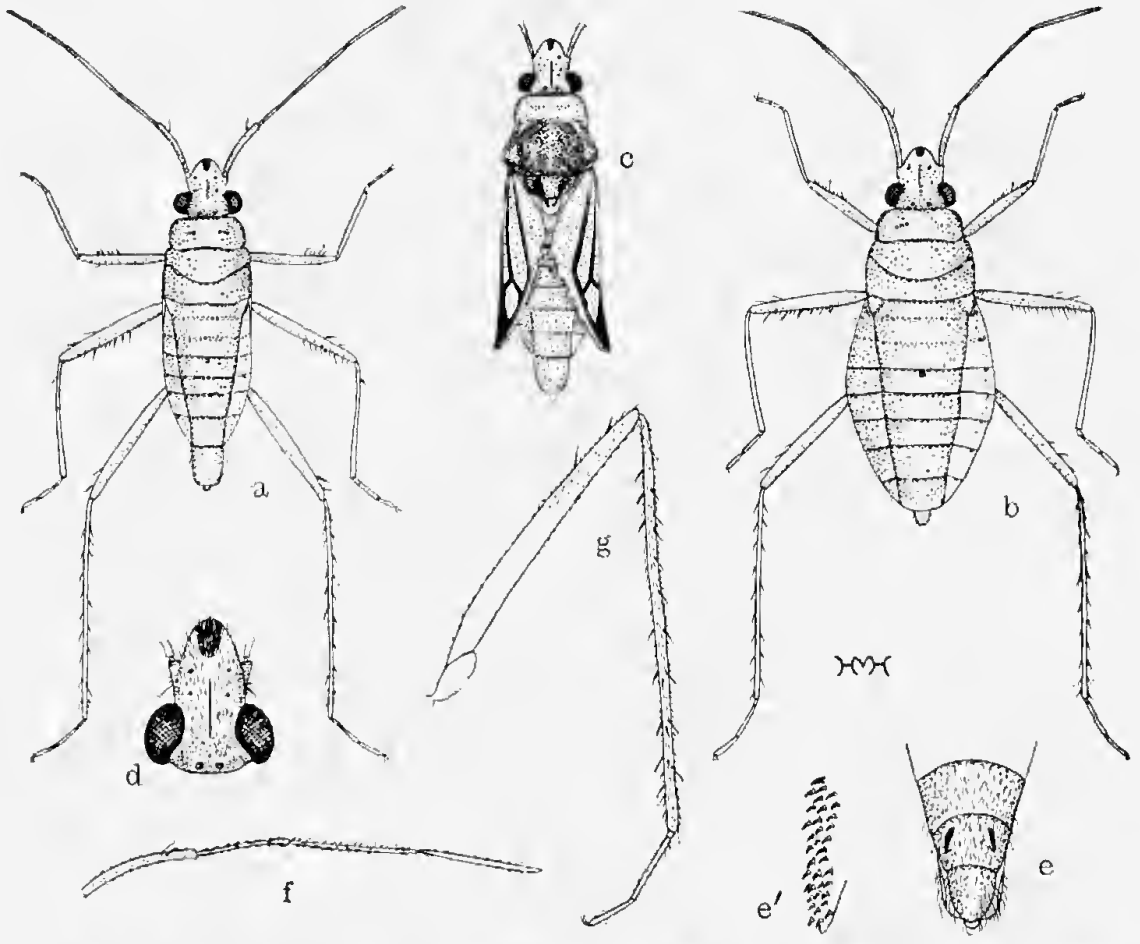

Fig. 82. *Mesovelia hungerfordi*; *a* and *b*, apterous male and female; *c*, macropterous male with mutilated hemelytra; *d*, front view of head of macropterous male; *e*, ventral view of genital segments of male; *e'*, one of the ventral elevations further enlarged; *f* and *g*, antenna and posterior leg of male.

short, stiff, brown hairs. Anterior femora with two setae on upper side near apex and several on underside; one-fourth longer than tibiae, which are about two and one-half times as long as tarsi; second segment of tarsi slightly shorter than third. Intermediate femora with two setae on upper side near apex and a row of setae on underside; subequal in length to tibiae, which are more than two and one-half times as long as tarsi; second tarsal segment a little longer than third. Posterior femora with two setae on upper side and none below; with

apices reaching well beyond tip of abdomen; tibiae one-fifth as long again as femora and more than three times as long as tarsi, the second joint of which is nearly half as long again as third.

Length, 3·12 mm.; width, ·8 mm.

Apterous ♀. Form much wider, legs and antennae relatively shorter and with segments of slightly different proportions than in male. Sub-ovate, two and one-half times longer than greatest width. Antennae reaching back nearly to level of fifth abdominal segment and apices of posterior femora extending to tip of abdomen. Second segment of posterior tarsi more than half as long again as third segment. Connexivum much wider than in male.

Length, 3·72 mm.; width, 1·4 mm.

Macropterous ♂. Pronotum a little wider than its median length; anterior lobe greenish-ochraceous, with two shallow impressions as in apterous form; tumid posterior lobe brown, with four indistinct spots and a longitudinal median line, pale. Scutellum greenish-yellow, with a brown marking on each side. Veins of hemelytra black; clavus, corium, and anterior part of membrane white, tinged with smoky brown; corium with a distinct apical cell.

Macropterous ♀. Width of pronotum at humeral angles about one-third greater than medial length.

Hab. South Australia: Adelaide (type loc.), Myponga and River Murray (H. M. Hale); New South Wales: Sydney (A. J. Nicholson).

It gives me much pleasure to associate with this species the name of Dr. H. B. Hungerford, by whose courtesy I have been able to examine the species of *Mesovelia*, and other aquatic and semi-aquatic bugs from North America. *M. hungerfordi* belongs to the group of species in which the male has a pair of elevated tufts of brownish-black spines on the venter of the first genital segment (*M. thermalis* Horv., *M. mulsanti* B. White, and *M. subvittata* Horv.); the elevations, however, are much larger, more elongate, and are more widely separated in *M. hungerfordi* than in the other species in which they are present. *M. mulsanti* is of about the same size as the Australian species, but is more slender in form. The type specimens of *M. subvittata* (two macropterous males) were collected in New Guinea; this species has no apical cell in the corium. In *M. thermalis* the pronotum of the macropterous form has no pale longitudinal, median line, and the metanotum of the apterous form is relatively longer than in *M. hungerfordi*.

Our species at times occurs in great numbers on the backwaters and irrigation drains of the River Murray, particularly when the surface of the water is covered with floating water-plants (*Lemna* and *Azolla*). Winged adults are comparatively rare, and in such as I have, the membrane of the hemelytra is

mutilated. Macropterous examples of *M. mulsanti* have been observed to rip the membrane off the wings with the hind tibiae, and so expose the genital segments—presumably to facilitate copulation (4). Torre Bueno notes this habit in several American Gerrids (5).

FAMILY VELIIDAE.

The species of two Veliid genera, *Trochopus* and *Halovelia*, are marine, but the remainder inhabit fresh water; Kirkaldy (6) unites *Trochopus* with *Rhagovelia*, but the two-jointed intermediate and posterior tarsi of the former separate them.

Structure. The body is plump, and the general shape in dorsal view is sub-oval, obovate, or sub-fusiform. The head is narrower than the pronotum, and the eyes are prominent, not very large, and exserted. The antennae are

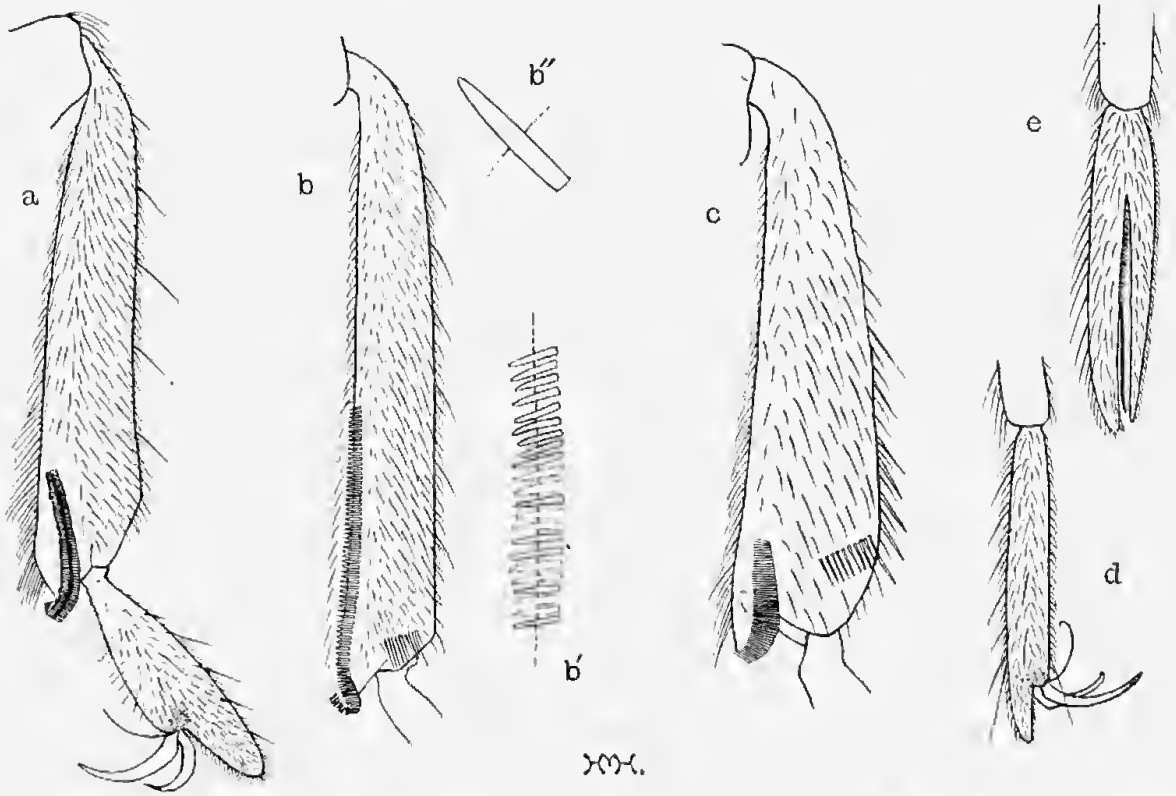

Fig. 83. *a*, Anterior tibia and tarsus of *Microvelia dubia*, male (100 diams.). *b*, Anterior tibia of *Microvelia howense*, male (100 diams.). *b'*, portion of tibial comb (315 diams.): *b''*, tooth of tibial comb (1,000 diams.). *c*, Anterior tibia of *Microvelia oceanica* (235 diams.). *d*, Terminal segment of intermediate tarsus of *Microvelia melancholica* (100 diams.). *e*, Terminal segment of intermediate tarsus of *Rhagovelia australica* (40 diams.).

(4) Hungerford, Psyche, xxiv, 1917, p. 80.
(5) Bueno, Ohio Nat., ix, 1908, p. 389-392.
(6) Kirk., Boll. Mus. Torino, xiv, 1899, p. 5.

four-segmentate, and, in at least the Australian representatives, there is a tiny jointlet at the base of the flagellum (third and fourth segments). This jointlet allows the two-segmented flagellum greater freedom of movement; in the descriptions it is included in the length of the third segment of the antennae. In *Halovelia* and the species of *Microvelia* now examined, a rake or comb, much resembling an ordinary hair-comb, is developed on the inner side of the anterior face of the fore tibiae in the male (fig. 83, *a* to *c*, and fig 84, *c*). In this sex the apex of the inner side of the tibia is forwardly produced beyond the level of the articulation of the tarsus; the rake extends along the distal part of the inner margin of the tibia, and is more or less curved over the apex of the produced part. The tibia is not apically produced, and the comb is absent in the female. The length and shape of the comb varies in the species, and is therefore a character of specific importance; it is probably present in many other representatives of the family. The tarsi are modified to support the bugs on the surface film of water; the claws are not terminal, but are inserted in a cleft or nick before the apex, which is bluntly rounded and pilose (fig. 83, *a* and *d*). In *Trochopus* and *Rhagovelia* the long terminal joint of the intermediate tarsi is deeply split (fig. 83, *c*), and accommodates a fan-like arrangement of pinnate hairs; this fan, when expanded, assists in supporting the insects on the surface film, and enables them to run rapidly, even upon swiftly-moving waters. In many forms the hind legs are longer than the intermediate or anterior pair, while in others, as for instance *Rhagovelia*, *Halovelia*, *Trochopus*, and some species of *Velia*, the middle limbs are longest. Species of most of the genera are known from both apterous and winged adults, although it seems that apterous individuals are most commonly met with. It is probable that, as in *Halobates*, wings are never developed in the aforementioned marine genera.

Habits. Feeding is predatory, but the anterior legs are not raptorial. Small animals living on floating vegetation are speared by the long rostral stylets, and thus held at the tip of the rostral sheath while their juices are ingested by their captor; tiny aquatic animals which approach closely to the surface are similarly transfixed.

KEY TO AUSTRALIAN GENERA.

a. Intermediate and posterior tarsi three-jointed; ultimate segment of intermediate tarsi longitudinally split from apex .. .. *Rhagovelia.*

aa. Intermediate and posterior tarsi two-jointed; ultimate segment of intermediate tarsi not split.

b. Intermediate legs markedly longer than posterior pair .. .. *Halovelia.*

bb. Intermediate legs not markedly longer than posterior pair .. .. *Microvelia.*

RHAGOVELIA Mayr.

Rhagovelia Mayr., Verh. zool.-bot. Ges. Wien, 1865, p. 445; Sign., Ann. Soc. Ent. France, 1877, p. liv.

Baccula Stal, Hem. Afr., iii, 1865, p. 167.

Neovelia B. White, Jour. Linn. Soc., xiv, 1879, p. 487.

Type, *R. nigricans* Burmeister.

The characters given in the key to the Veliid genera serve to distinguish this genus. Only one species is recorded from Australia.

RHAGOVELIA AUSTRALICA Kirkaldy.

Rhagovelia australica Kirk., Proc. Linn. Soc., N.S. Wales, xxxii, 1907, p. 783.

I have seen two examples, with mutilated antennae, collected by Dr. Mjoberg.

Hab. Queensland: Kuranda (type loc.), Malanda (Mjoberg).

HALOVELIA Bergroth.

Halovelia Berg., Ent. Month. Mag., xxix, 1893, p. 277.

Type, *H. maritima* Bergroth.

In this genus the body is densely pilose, and in dorsal view the form is widely oval or ovate. The pronotum is very short and transverse, while the mesonotum is greatly enlarged and posteriorly is produced over the anterior part of the abdomen. The intermediate legs are markedly longer than the others; the tarsi of the intermediate and posterior limbs are two-segmented, and the claws of the middle pair are inserted very close to the apex.

Halovelia differs from the allied American genus *Trochopus* in not having the intermediate tarsi split and furnished with a fan of hairs, and in having the mesonotum very much larger, and the visible portion of the abdomen consequently smaller. The members of both genera are of marine or estuarine habit.

HALOVELIA MARITIMA Bergroth.

Halovelia maritima Berg., *loc. cit.*

♂ Form sub-oval, one and two thirds times longer than wide, and broadest at about middle of mesonotum. Head black, marked with brown on basal third; densely clothed with pale pubescence, intermixed with a few long hairs; large and prominent, including eyes slightly wider than anterior margin of pronotum. Eyes reddish-black, relatively small. Antennae black, with rather long, whitish pubescence; almost two-thirds as long as total length of insect; first segment thickened on distal half, curved, almost half as long again as second, and with bulbus small; fourth very slightly shorter than the first, stout and thick, elliptical

in shape; third segment shorter than fourth and longer than second. Pronotum black, brownish towards posterior margin; basal width five times medial length, which is little more than one-third the length of the head; anterior and posterior margins slightly curved, almost straight; lateral margins very oblique.

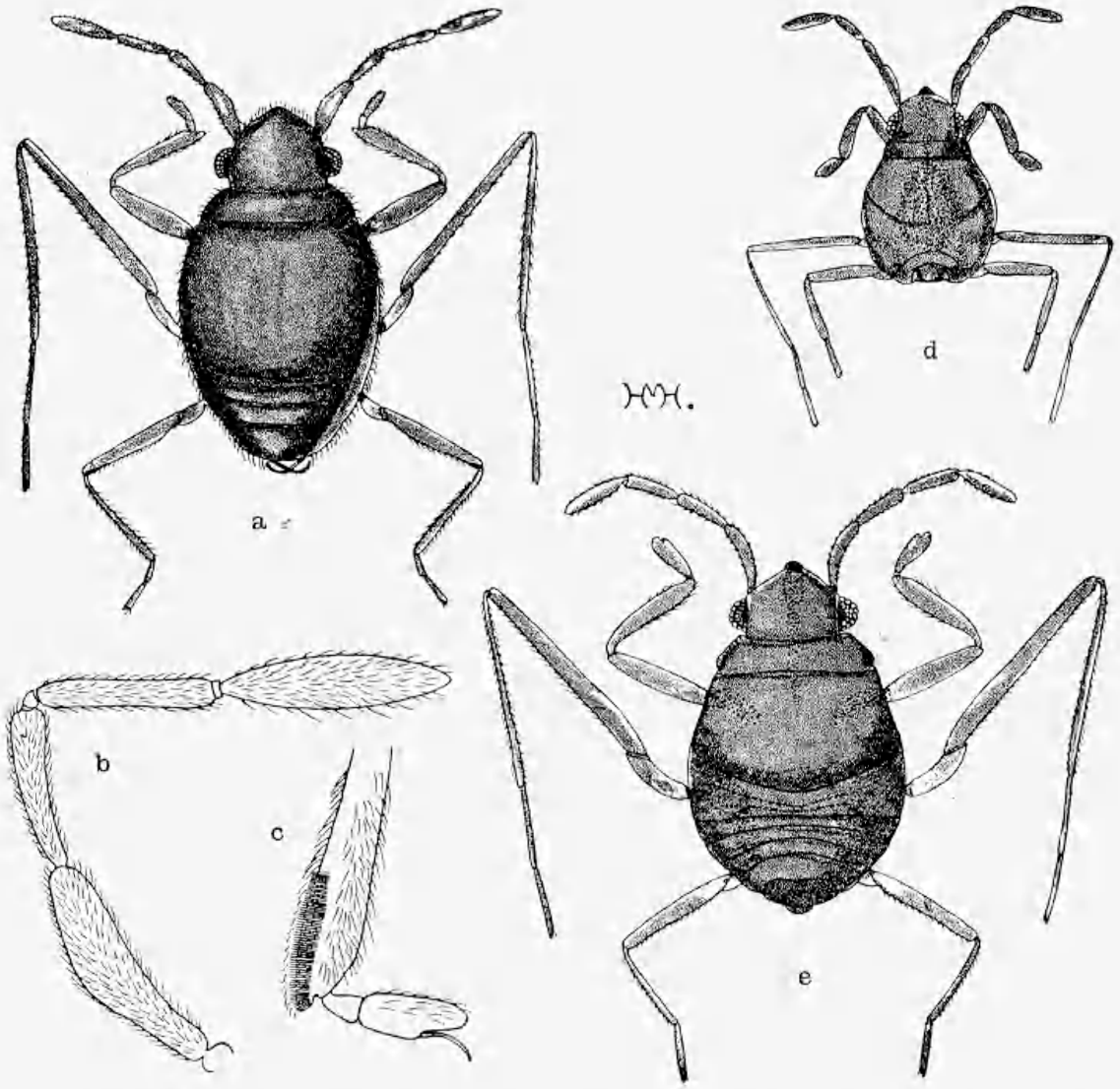

Fig. 84. *Halovelia maritima*; *a*, adult male; *b*, antenna; *c*, anterior tarsus and portion of tibia, showing comb; *d*, third (?) instar nymph; *e*, female of last nymphal instar. (*a*, *d*, and *e* are drawn to same scale.)

Mesonotum black, clothed with short, pale pubescence; very convex, and wider than long. Abdomen black above, densely and palely pubescent; subtruncate posteriorly; exposed portion slightly more than one-half as long as mesonotum; connexivum thick, with long pubescence on edges; slightly and obliquely elevated. Underside brown, merging into black laterally; clothed with whitish hairs, which

are dense and moderately long towards lateral margins, but are sparse on disc of sternum and abdomen. Basal joints and distal half of apical joint of rostrum black; remainder brown; apex reaching beyond anterior coxae. Legs brown, clothed with yellowish hairs; coxae of intermediate and posterior limbs widely separated. Anterior legs a little shorter, but stouter than last pair, which are but half as long as the intermediate pair. Anterior femora subequal in length to tibiae; distal end of outer side of tibiae closely set with stout, short setae; inner inferior margin apically produced, and, with a comb, consisting of about seventy teeth, occupying three-sevenths of its length; apex of tibiae bifurcate, and on outer part sloping obliquely away from articulation of tarsus; anterior tarsi less than one-half as long as tibiae; composed of three segments, the first minute and almost invisible, the second short and one-third as long as the stout terminal segment. Intermediate and posterior fulchra conspicuous, curved, projecting well beyond body. Intermediate tibiae scarcely shorter than femora and two-fifths longer than tarsi, the first joint of which is one-third longer than second. Posterior tibiae almost as long as femora and twice as long as tarsi, the second segment of which is nearly three-fourths longer than the first.

Length, 1·4 mm.; width, ·85 mm. to ·87 mm.

♀ Form widely ovate, not widest at middle of mesonotum. Size larger and connexivum wider than in male.

Length, 1·96 mm.; width, 1·2 mm.

THIRD (?) INSTAR NYMPH.

Fig. 84, *d*.

Form somewhat ovate, a little less than half as long again as wide; broadest behind mesonotum. Antennae stout, four-fifths as long as total length of insect; proportions of segments much as in adult, but basal jointlet of flagellum not apparent. Anterior legs very stout; tibiae not apically produced on inner side, less than twice as long as the single-jointed tarsus. Intermediate femora and tibiae equal in length; tibiae about one-third longer than tarsi, which (when cleared and mounted) appear somewhat obscurely two-jointed, the two segments subequal in length. Posterior legs short and moderately stout; femora scarcely longer than tibiae, which are more than half as long again as single-jointed tarsi. Clothing comparatively sparse.

Length, ·85 mm.; greatest width, ·575 mm.

FINAL NYMPHAL INSTAR.

Fig. 84, *e*.

♀ Form ovate, more than half as long again as greatest breadth; widest

behind mesonotum. Antennae moderately stout, slightly more than two-thirds as long as total length of insect; basal jointlet of flagellum very tiny. Anterior legs stout, tibiae not apically produced; tarsi imisegmentate, thickened towards apex, less than half as long as tibiae. Intermediate femora slightly longer than tibiae, which are one-third longer than tarsi; tarsi two-jointed, the first joint a little longer than second. Posterior femora longer than tibiae; tarsi single-jointed, more than one-half as long as tibiae. Clothing much more pronounced than in nymph previously described, but hairs of legs and antennae not so dense as in imago.

Length, 1·49 mm.; greatest width, ·925 mm.

Hab. Timor Sea; Cartier Island (type loc.); Western Australia: Pelsart Islands (A. M. Lea).

The type specimens of this interesting species were taken "under blocks of coral, below high-water mark" (7). Cartier Island is nearer to Timor than to Australia, being 175 miles from our north-western coast. Bergroth remarks that *H. maritima* "is probably the only insect of Cartier Island." The Hontmans Group is quite close to the mainland of Western Australia, and Mr. Lea captured the examples described above, under stones on a Pelsart reef, many years ago; four adult males, a damaged adult female, and two nymphs were preserved. The imagoes agree well with Bergroth's description, excepting that the segments of the posterior tarsi can scarcely be said to be "longitudine subaequalibus". The sex of the type is not stated, but in length (2 mm.) it agrees with the female now examined.

MICROVELIA Westwood.

Microvelia Westw., Ann. Soc. Ent. France, iii, 1834, p. 647; Amy. & Serv., Hem., 1843, p. 421; Doug. & Scott, Brit. Hem., 1865, p. 574; Sahl., Medd. Soc. Faun. Fl. Fenn., i, 1876, p. 88.

Hydroessa Burm., Handb., ii, 1835, p. 213; Fieb., Europ. Hem., 1861, p. 33, 104; Stal., Hem. Afr., iii, 1865, p. 167.

Type, *Microvelia pulchella* Westwood.

These small black bugs are taken on quiet streams and backwaters, or on isolated pools, rather than on the surface of rapidly moving water. They have not been extensively collected in Australia, indeed few specimens are to be found in our museums. In 1916 Bergroth described *M. australica*, taken twenty years before by the Horn Expedition in Central Australia; this is the first record of the genus for our region. I have examined specimens taken by Dr. Mjoberg in the northern half of the continent, others captured by Mr. Nicholson in New

(7) See also Walker, Ent. Month. Mag., xxix, 1893, p. 229.

South Wales, a few collected by Mr. A. M. Lea, and those taken by myself in South Australia. Seven species are now listed for Australia.

Food. Bueno (8) fed *Hieroveliia americana* with flies, and Hungerford (9) describes in interesting detail the manner in which another American species (*M. borealis*) impales Ostracods by thrusting the beak between the hard valves of the crustaceans. Butler (10) suggests that, in the case of the European *M. reticulata*, "Pond water may possibly be sufficiently charged with organic matter to yield all the sustenance such minute insects need". This author notes the observations of Bueno and Hungerford, but remarks that "*M. americana* is much larger than our species". There is little doubt, however, that all species are carnivorous, and capable of subduing animals as large as themselves. Some notes on feeding are herein given for the two South Australian species, one of which, like *M. borealis*, is no larger than the aforementioned European species.

The Australian species may be separated by the structure of the antennae; also, as mentioned above, the anterior tibial comb of the male is a specific character of some interest. These are the main differences utilized in the following key. The "bulb of insertion" is not included in the length of the first segment of the antennae, and the basal jointlet of the third segment is included in the length of that segment.

KEY TO AUSTRALIAN SPECIES.

a. First segment of antennae distinctly longer than second.
  b. First segment of antennae longer than third.
    c. Fourth segment of antennae long, more than twice as long as second; anterior tibial comb of male less than one-fourth the length of inner margin of tibiae .. .. *oceanica.*
    cc. Fourth segment of antennae short, less than one-third longer than second; anterior tibial comb of male one-half the length of inner margin of tibiae .. .. *howense.*
  bb. First segment of antennae not longer than third.
    d. Fourth segment of antennae more than two-thirds as long again as second segment; anterior tibial comb of male at least one-half the length of inner margin of tibiae.
      e. Form elongate; antennae long and slender; anterior tibial comb of male almost two-thirds the length of inner margin of tibiae .. .. .. *mjobergi.*

(8) Bueno, Can. Ent., xlii, 1910, p. 176.
(9) Hungerford, Bull. Univ. Kansas, xxi, 1919, p. 138.
(10) Butler, Biol. Brit. Hem.-Het., 1923, p. 239.

ee. Form stout; antennae shorter and stouter; anterior tibial comb of male little more than one-half the length of inner margin of tibiae .. .. *peramoena.*

dd. Fourth segment of antennae less than one-third as long again as second segment; anterior tibial comb of male less than one-third the length of inner margin of tibiae .. *dubia.*

aa. First segment of antennae shorter than, or subequal in length to, second.

f. First and second segments of antennae subequal in length; hemelytra whitish; rostrum scarcely passing prosternum .. .. *australica.*

ff. First segment of antennae shorter than second; hemelytra black; rostrum extending to middle of mesosternum .. .. *melancholica.*

MICROVELIA OCEANICA Distant.

Microvelia oceanica Dist., Nova Caledonia, Zool., i, 1914, p. 383, pl. xii, fig. 10-11.

Macropterous ♂. Narrow, widest across humeral angles of pronotum. Head black, dull, sparsely clothed with whitish pubescence, and with a patch of bluish pubescence alongside inner margin of each eye; obsoletely carinate, finely punctate, and with several large punctures forming a sub-marginal line

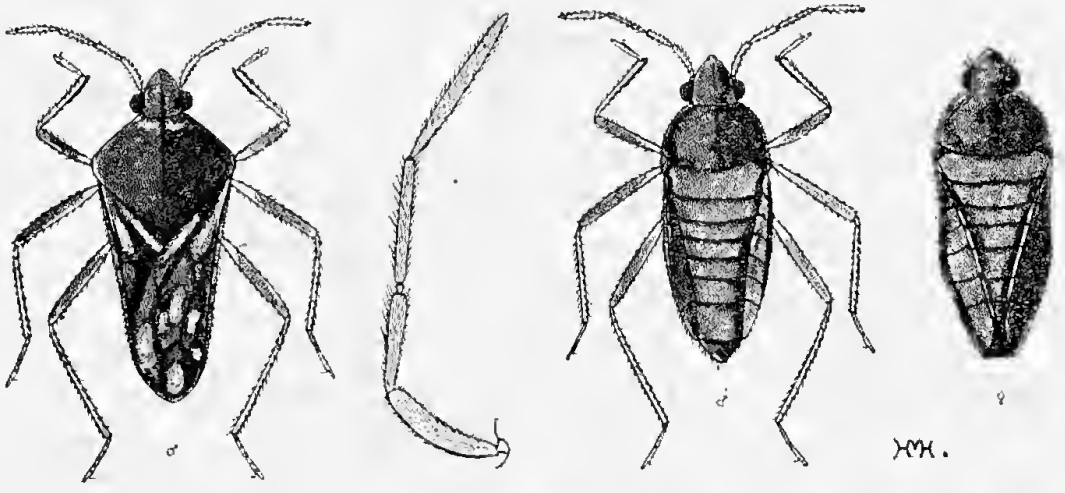

Fig. 85. *Microvelia oceanica*: macropterous male, and apterous male and female.

on each side. Antennae brown, darkened at apices of first to third segments and paler on proximal half of first; short and slender, not as long as head and pronotum together; first segment nearly one-fourth longer than second, subequal in length to third and about three-fifths as long as the fourth, which is more than twice as long as the second. Pronotum black, with posterior margin narrowly

bordered with dark ochraceous, and with an anterior sub-marginal fascia, not reaching to lateral margins, of same colour: clothed with pale pubescence; distinctly wider than long, and with an obsolete median carina and prominent humeral angles: surface dull, finely punctate, with a line of large punctures at hinder edge of anterior fascia, and another series sub-marginal and parallel to the posterior margin of pronotum. Hemelytra brownish-black, with a pair of luteous curved markings within central areole, a prominent milk-white spot within apical area, and a more or less distinct luteous streak within each remaining areole; not quite reaching to outer edges of connexivum and extending beyond apex of abdomen. Apical segment of rostrum almost black; face dark ochraceous. Rostrum reaching to between hinder edges of anterior coxae. Sternum and underside of abdomen black, with a bluish tinge; dull, clothed with very short, whitish pubescence. Legs slender; acetabula, coxae, and fulchra ochraceous. Anterior femora ochraceous, with apex brown; a little less than one-fourth longer than tibiae, which are one-half as long again as tarsi; tibial comb very short, occupying less than one-fourth of length of inner margin of tibiae. Intermediate and posterior femora ochraceous, with apices and a streak on distal two-thirds of upper and lower margins dark brown; rest of legs dark brown. Intermediate tibiae slightly shorter than femora and about half as long again as tarsus, the second segment of which is nearly half as long again as first. Posterior femora not nearly reaching to apex of abdomen, about one-seventh shorter than tibiae, which are a little more than twice as long as tarsi; second segment of tarsus one-third longer than first.

Macropterous ♀. Form slightly more robust than in male. Anterior tibiae about one-third as long again as tarsi.

Length, 1·7 mm. to 2·4 mm.; width, ·7 mm. to ·96 mm.

The hemelytra are very pale brown or whitish in some specimens, while in others they are almost wholly black with but faint indications of areolar markings.

Apterous ♂. Form sub-fusiform. Pronotum about twice as wide as medianly long. One or two genital segments visible; connexivum more or less erect.

Apterous ♀. Form wider than in male. Connexivum horizontal, erect or infolded over dorsum of abdomen, sometimes meeting over seventh abdominal segment.

Colour. Head as in winged form. Pronotum black, with posterior margin yellow or orange and with an anterior yellow or orange fascia, which in some specimens reaches to lateral margins, in others is narrow and medianly interrupted, and is occasionally covered with silvery pubescence. First dorsal abdominal segment black, brownish or (rarely) red, with or without bluish bloom on median line and posterior margin. Dorsum of each of remaining abdominal

segments wholly black, or with disc brown, varyingly marked with bluish bloom; segments five to seven sometimes with velvety black bloom on disc. Connexivum ranging from black to lemon-yellow with sutures brown: with or without bluish bloom. Sternum and underside of abdomen wholly black (often wholly covered with bluish bloom) or lemon-yellow with a bluish streak on sides and the sutures brown.

Length, 1·66 mm. to 2 mm.; width, ·68 mm. to ·85 mm.

Hab. New Caledonia (type loc.). South Australia: Adelaide, Myponga Swamps, Murray River, Port Wilhinga, and Northern Flinders Ranges (H. M. Hale); Queensland: Cairns (A. M. Lea); New South Wales: Myall Lakes (A. J. Nicholson), Broken Hill (F. W. Shepherd), Dorrigo; Tasmania: Devonport (A. M. Lea); Lord Howe Island (A. M. Lea); New Zealand: Nelson, *etc.* (J. G. Myers).

The distribution of the species is interesting. As indicated above, the colouration is considerably variable in a long series of the apterous form; the shape in dorsal view is variable in the female (less markedly so in the male), owing to the different angles assumed by the connexivum.

This species is apparently very closely allied to *M. macgregori* Kirk. [11], but the specimens before me differ from Kirkaldy's description of that species in the relative lengths of the segments of the antennae and legs; in *M. oceanica* the first and second segments of the antennae are not subequal in length and the first tarsal segment is not subequal in length to the second in either the intermediate or posterior legs. Distant describes a single winged specimen, and states that he examined a series of the apterous form; he figures the macropterous example (which appears to be a female) and an apterous female. The colour markings of some of the Australian specimens are as in these illustrations.

M. oceanica is the commoner of the two species occurring in South Australia. As with other members of the family, it is gregarious, and is occasionally found in very considerable number; it commonly inhabits pools with abundant surface vegetation, but also favours the quieter creeks, in which it keeps close to the shore, never venturing far out into the stream. At the Myponga swamps are many permanent pools, closed in by dense scrub, and crowded with a dense growth of *Myriophyllum* in summer. Such pools contain a variety of sub-aquatic bugs, insect larvae, Ostracods, etc., and on the surface of many of them this little species occurs abundantly. The winged form has been taken on water standing in buckets and other receptacles.

M. oceanica, in company with *Mesovelia hungerfordi*, appeared regularly each summer, for some years, upon an artificial pond containing *Potamogeton* and

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(11) Kirk., Rev. d'Ent., xviii, 1899, p. 91, and Trans. N. Zeal. Inst., xl, 1907, p. 109.

water-lilies. Green aphids lived upon the leaves of the water-lilies, and, while the sun was shining on the pond, the *Microveliae* were repeatedly seen to spear the "plant-lice". A victim is held at the tip of the beak, with no other support than that of the rostral stylets, the beak being held straight out in front of the head. On one occasion a tiny bug transfixed an aphid fully as large as itself and, at the first attempt to lift the captive, overbalanced and fell on its back on the surface of the lily leaf; the aphid was not released. The *Microvelia* quickly righted itself, and commenced to feed in the usual way.

Bueno describes the toilet preparations of *M. americana:* doubtless all species are of necessity equally cleanly. *M. oceanica* occupies a considerable part of its time in combing the hairs of the body, legs, and antennae.

In mating, the male approaches the female from the rear and, with a sudden little hop, jumps on to her back. Pairs were observed *in copula* in July, with the water at a temperature of 60° F., and in January, on a tiny pool, with the water at 90° F.

MICROVELIA HOWENSE sp. nov.

Apterous ♂. Form narrowly obovate, tapering, widest at prothorax, three times longer than wide. Head brownish-black, dull, with a shining, black median carina, a raised, shining, black spot near intero-lateral angles of eyes, and a few black punctae; with long, pale yellow pubescence alongside inner margins of

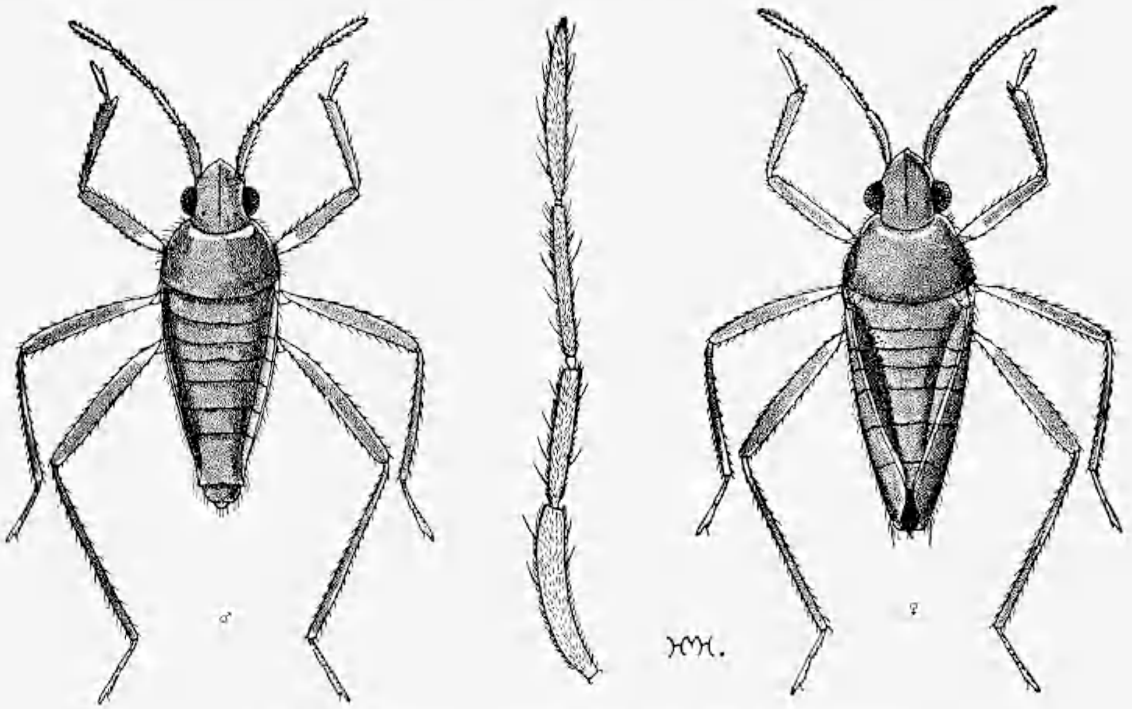

Fig. 86. *Microvelia howense;* apterous male and female.

eyes, and stiff, black hairs towards apex; sparsely pubescent on disc; large and prominent, well produced sub-conically in front of eyes; medial length about equal to width, including eyes. Antennae brown, clothed with dense, pale pubescence intermixed with longer hairs; rather stout, and about as long as abdomen; first segment slightly curved, one-fourth longer than second, a little longer than third (which is the most slender) and equal in length to fourth. Pronotum black, with an almost interrupted, anterior, yellow fascia; surface dull; disc with very sparse and short yellowish pubescence, and some stout, black hairs, which are thickly set laterally; medial length a little more than one-half humeral width; a very obsolete median carina; posterior margin evenly convex and lateral margins slightly sinuate. Dorsum of abdomen black, each segment brownish on centre of disc; surface dull, clothed with pale, yellow pubescence; a patch of shining, silvery pubescence and a few black hairs near posterior angles of metanotum; seventh segment longer than wide, posterior margin emarginate. Genital segments brown, shining, prominent, the first medianly carinate. Connexivum dark ochraceous, clothed with stiff, black hairs; sub-erect. Face yellowish-brown. Rostrum brown, black at apex; reaching to posterior margin of prosternum. Underside brown, in parts black, with pubescence almost absent on disc. Surface of sternum sub-nitid, of abdomen dull. Legs long, with coxae, fulchra, and basal third of femora, ochraceous; remainder brown. Anterior femora a little longer than tibiae, which are more than twice as long as tarsi; tibial comb occupying the anterior half of the length of inner side, and curving over the apex of the produced portion. Intermediate tibiae as long as femora and nearly twice as long as tarsi, the second segment of which is one-third longer than first. Posterior femora reaching almost to apex of abdomen: tibiae more than one-fourth longer than femora and scarcely more than twice as long as tarsi, the second joint of which is about one-third longer than first.

Length, 2·8 mm.; width, ·9 mm.

Apterous ♀. Pubescence on dorsum of abdomen extremely sparse. Connexivum bent inwards over abdomen, sub-erect, converging for greater part of length and almost meeting at middle of sixth segment; on posterior half of this segment the two sides of the connexivum form a cup, from which emanates a bunch of setae.

Length, 3 mm.; width, 1·1 mm.

Hab. Lord Howe Island; Erskine Valley, Mount Gower (A. M. Lea).

A series was taken from fresh water in "rockholes". This and the previous species are scarcely typical representatives of *Microvelia*. The long legs are distinctive; the teeth of the tibial comb are very closely set towards the recurved apical portion; in all, there are about eighty to ninety teeth in the comb.

MICROVELIA MJOBERGI Hale.

Microvelia mjobergi Hale, Arkiv f. Zool., K. Svenska Vet.-Akad., xvii A, 1925, p. 6, fig. 4.

This species is known only from the apterous form. It is allied to *M. peramoena*, but differs in having the antennae longer and more slender, the form

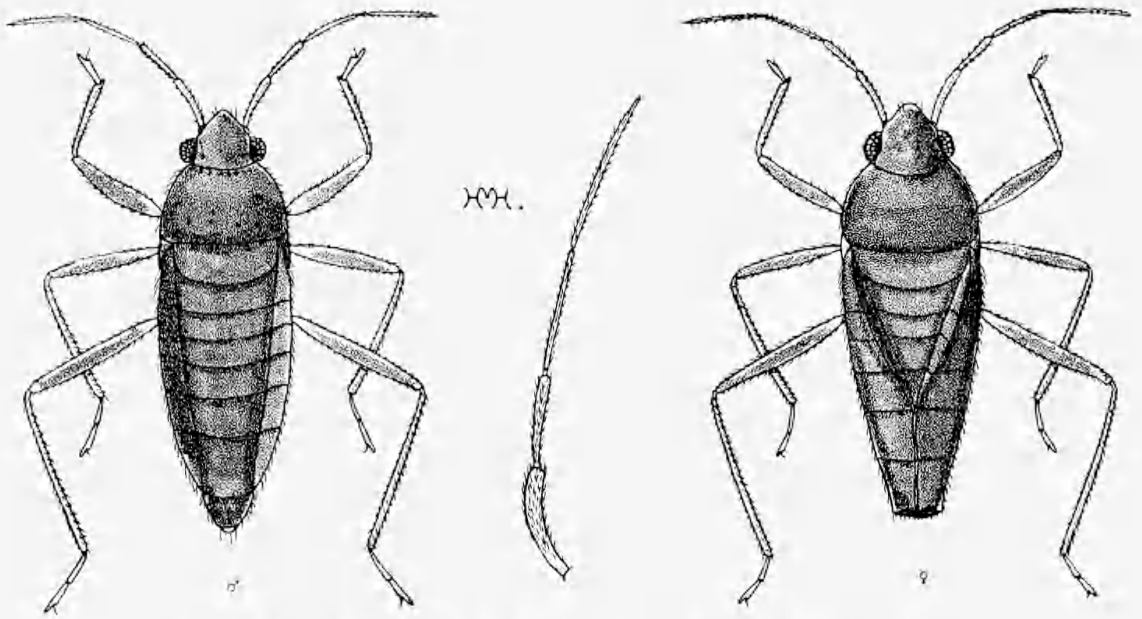

Fig. 87. *Microvelia mjobergi*: apterous male and female.

more elongate, and the legs and antennal segments of slightly different proportions; also, the anterior tibial comb of the male is relatively longer, occupying nearly two-thirds of the length of the inner margin of the tibiae.

Length, 3 mm.; width, 1 mm.

Hab. Queensland: Herberton (type loc.).

MICROVELIA PERAMOENA Hale.

Microvelia peramoena Hale, *loc. cit.*, p. 8, fig. 5.

The following characters separate this from other Australian species:

Form robust; macropterous male less than two and one-half times as long as greatest width; apterous male less than three times longer than broad; females a little stouter. Antennae rather short, little more than one-half the total length of the insect; first segment curved, one-sixth longer than second, a little shorter than third and slightly more than three-fourths as long as fourth. Anterior tibial comb of male occupying about one-half the length of inner margin of tibiae. Posterior femora not nearly reaching to apex of abdomen. Rostrum extending almost to middle of mesosternum.

Macropterous form: Length, 2·35 mm. to 2·55 mm.; width, 1 mm. to 1·3 mm.

Apterous form: Length 2·35 mm. to 2·55 mm.; width, ·96 mm. to 1·15 mm.

Hab. I have examined specimens from various localities in South Australia, Queensland, New South Wales, Victoria, Western Australia, and Tasmania.

This species, and the much smaller and more slender *M. oceanica*, are the only members of the genus so far met with in South Australia. In this State *M. peramoena* occurs commonly in both winged and apterous state, wingless examples being the more plentiful. It is found in greater number on clear, slowly running, weedy streams than in any other situation, but has also been

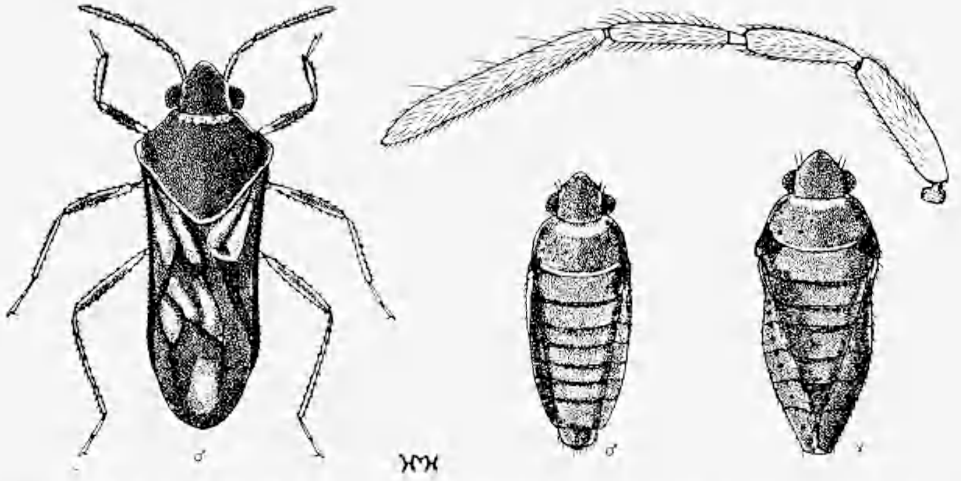

Fig. 88. *Microvelia peramoena*; macropterous male and apterous male and female.

obtained from dams, horse troughs, and other stagnant waters. I have taken both winged and apterous examples from the surface of rainwater retained in smooth pot-holes worn in rocky cliffs near the coast, these temporary pools being destitute of vegetation or shelter of any kind.

During a recent visit to the Northern Flinders Ranges this species was observed on the surface of deep, clear, reed-lined pools at the bottom of the beautiful gully through which the Wilpena Pound is entered. The bugs were congregated in little groups wherever a tiny larva had fallen on to these quiet waters from the tall, overshadowing eucalypts, and were busily engaged in extracting the juices of the caterpillars. As many as nine *Microveliae* were observed feeding at the same time upon a caterpillar only 5 mm. in length.

MICROVELIA DUBIA sp. nov.

♂ Form sub-fusiform, two and three-fourths times longer than wide. Head black, with brownish collum; dull, and clothed with pale pubescence. Antennae brown, with golden pubescence; about as long as abdomen; first segment

a little longer than second and slightly shorter than third or fourth, which are subequal in length. Pronotum sparsely clothed with whitish and black pubescence mixed; nearly five times as wide as medianly long; ochraceous and sub-nitid on disc, black on sides, with posterior margin sinuate; mesonotum black, dull, with hinder margin convex. Dorsal abdominal segments one to six brownish-black, dull, and clothed with sparse, pale pubescence and some stiff black hairs; dorsum of seventh segment brownish-black on anterior two-thirds, ochraceous and sub-nitid posteriorly, clothed with conspicuous black hairs; wider than long. Disc of genital segment ochraceous, shining; sides blackish. Connexivum reddish-

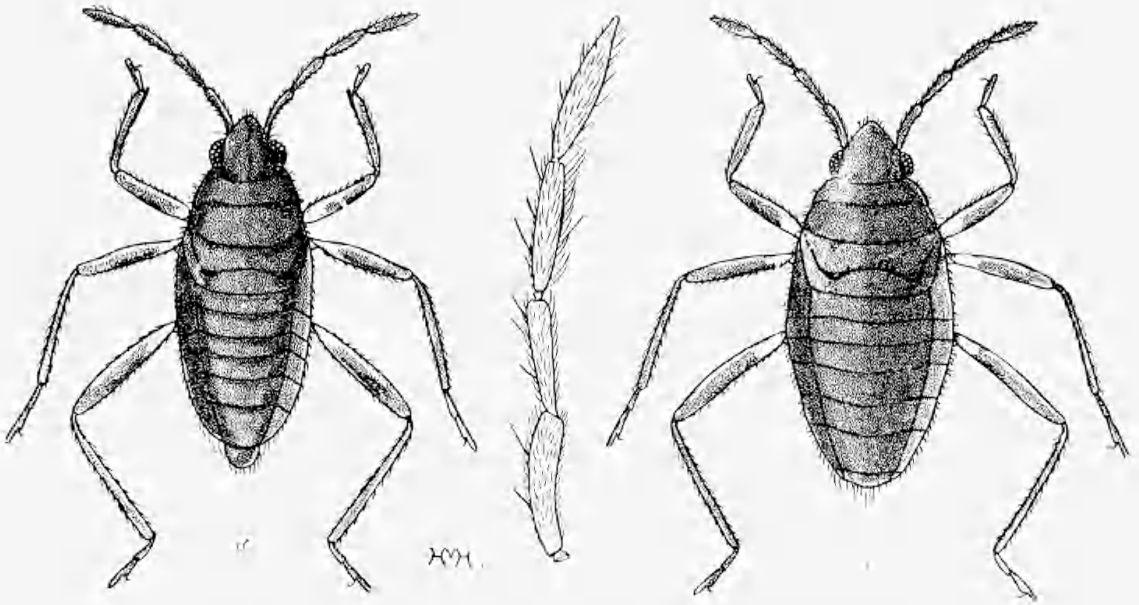

Fig. 89. *Microvelia dubia*: apterous male and female.

brown, with clothing as on dorsum of abdomen; sub-erect. Rostrum ochraceous, with a broad median stripe and whole of terminal segment blackish-brown. Sternum brown, and underside of abdomen dark brown; clothed with very short and sparse, pale pubescence, and with black hairs on sides. Coxae, fulchra, and proximal half of femora ochraceous; remainder of legs dark brown. Anterior femora stout, subequal in length to tibiae, which are about twice as long as tarsi; tibial comb narrow, less than one-third the length of inner margin of tibiae. Intermediate femora subequal in length to tibiae, which are about twice as long as tarsi. Posterior femora a little shorter than tibiae, which are two and one-half times as long as tarsi. Intermediate and posterior tarsi with second segment twice as long as first.

Length, 2·5 mm.; width, ·96 mm.

♀ Form oval, about two and one-third times longer than wide. Seventh dorsal abdominal segment short, posteriorly sub-truncate.

Length, 2·5 mm.; width, 1·1 mm. to 1·25 mm.

Hab. Tasmania: Devonport (type loc.) (A. M. Lea); New South Wales: Mount Kosciusko (A. J. Nicholson).

In females from Mount Kosciusko the tip of the abdomen is bent down and the connexivum is not at all erect, so that the insects are sub-ovate in form. Mr. Nicholson discovered these specimens "skating on the surface of still water amongst the vegetation at the edge of a mountain stream".

Presuming that the specimens described above represent a phase somewhat similar to that stated by Bergroth to occur in some apterous Gerrids, I have referred this species to *Microvelia*. Writing of the thorax of the Gerridae, Bergroth ([12]) remarks, "In the same species it is possible to find two apterous forms, both with well-developed genitalia; one with the pronotum more or less fused with the mesonotum . . . the other with the mesonotum distinctly separated from the pronotum".

MICROVELIA AUSTRALICA Bergroth.

Microvelia australica Berg., Proc. Roy. Soc. Viet., xxix, 1916, p. 38.

This small species is evidently very nearly allied to *M. oceanica* Dist. and *M. macgregori* Kirk. Bergroth states that the second joint of the antennae is "as long as the first" (as in *M. macgregori*), while Distant, in describing the antennae of *M. oceanica*, says, "first joint . . . slightly longer than second". According to the descriptions this seems the only character of importance separating *M. australica* from *M. oceanica*.

MICROVELIA MELANCHOLICA Hale.

Microvelia melancholica Hale, *loc. cit.*, p. 5, fig. 3.

Macropterous ♂. Form slender, nearly three times as long as greatest breadth. Antennae about one-half of total length of insect; first segment curved, a little more than three-fourths as long as second and two-thirds as long as fourth, which is slightly longer than third segment. Anterior tibiae a little shorter than the stout femora and two and one-third times as long as the tarsi, with a comb occupying about one-third of length of inner margin. Intermediate tibiae subequal in length to femora and one-eighth as long again as tarsi, the first segment of which is one-fourth longer than second. Posterior tibiae one-tenth longer than femora and one-half as long again as tarsi, the first segment

([12]) Berg., Ent. Month. Mag., xxxviii, 1902, p. 259.

of which is nearly one-third longer than second. Rostrum reaching nearly to middle of mesosternum.

Length, 2·75 mm. to 2·9 mm.; width, ·95 mm. to 1 mm.

Macropterous ♀. Form stouter and size larger than in male: abdomen swollen.

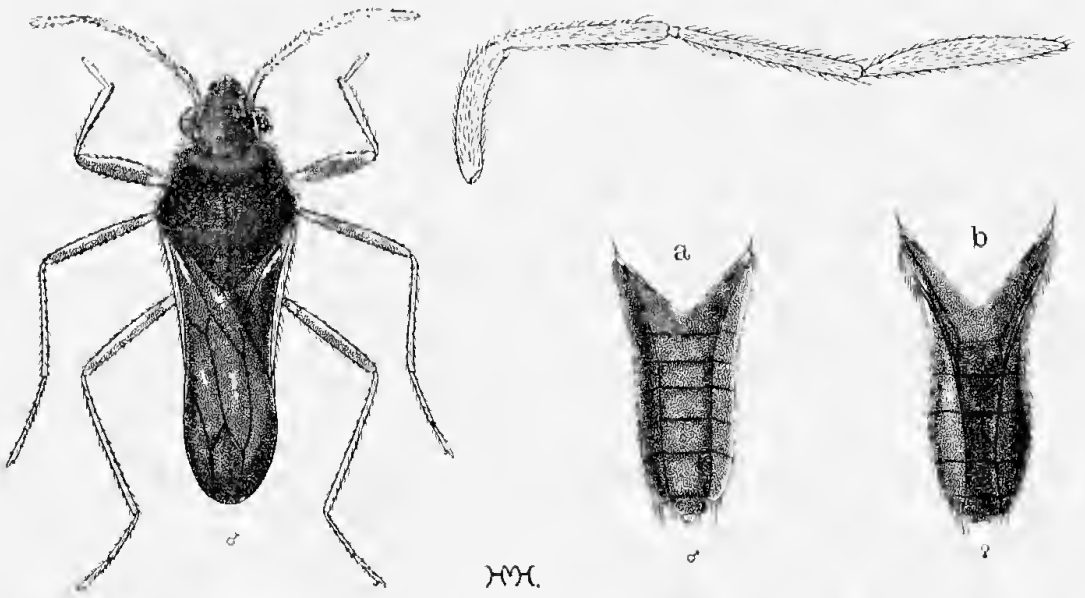

Fig. 90. *Microvelia melancholica*: macropterous male; *a* and *b*, dorsal view of abdomen of male and female.

Length, 3·4 mm. to 3·65 mm.; width, 1·2 mm. to 1·25 mm.

Hab. Queensland: Malanda and Herberton (type loc.).

The illustration shows the differences in the abdomen of the sexes. This distinct species is readily recognized by the dark colouration, slender form, and the proportions of the segments of the legs and antennae. It is known from the winged form only.